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A SOCIAL COMPONENT IN THE NEGATIVE EFFECT OF SONS ON MATERNAL LONGEVITY IN PRE-INDUSTRIAL HUMANS

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Summary. Due to their effect on maternal testosterone levels, sons are said to have reduced maternal longevity in pre-industrial humans. This analysis, using information from a Flemish agricultural village in the 18th–20th centuries, confirms the presence of a negative effect of sons on maternal longevity. However, the effect is mainly observed for mothers belonging to the least privileged social group and for sons surviving their fifth birthday. Both findings make the above-mentioned biological explanation relative. However, a plausible alternative, social interpretation is male-dominated intra-household resource competition. It is reasonable to assume that only sons above a certain age are able to claim a serious amount of resources and that competition is strongest within the least privileged social group.

Introduction

Helle *et al.* (2002) observed in a pre-industrial Sami population that sons reduced maternal longevity. This pre-industrial population is said to experience natural mortality because of a lack of advanced medical care. Helle *et al.* suggest that biological, pregnancy-related mechanisms underlie this effect, and refer in particular to the association of male fetuses with elevated maternal testosterone levels. Testosterone is an immunosuppressor and therefore this phenomenon may lead to a decreased survival of mothers who have borne several sons.

The aim of the present paper is to introduce social arguments into the debate. Firstly, to check whether the negative effect of sons on maternal longevity is also present in a different social context, the analysis of Helle *et al.* (2002) is replicated using data from a small Flemish village. Secondly, the analysis is refined by discussing the influence of social position (and period). This is because it might not be excluded that in relatively well-to-do families (compared with families of ordinary labourers)

the negative effect of sons is suppressed. Thirdly, an alternative, social explanation for the effect itself is discussed. Male-dominated intra-household resource competition as a possible explanation is explored by comparing the effect of sons surviving their fifth birthday (competitors with mothers) with those who don't (non-competitors).

Analysis

Data

The analysis is performed using demographic data from the village of Moerzeke, eastern Flanders, Belgium, gathered from church and civil registration certificates (Matthijs *et al.*, 2002). The historical population database contains information on 1062 women (and their family members) born between 1700 and 1870 (born and deceased in Moerzeke). The analysis is limited to not-remarrying women, to keep the selected group as pure as possible. These women have children in only one household. Furthermore, remarriages are qualitatively different from first marriages (Matthijs, 2001). The analysis is also limited to women dying after their fiftieth birthday, to avoid the influence of short-term pregnancy-related mortality.

Replication of Helle et al. *study*

In the study period (18th–20th centuries), Moerzeke was mainly dependent upon agricultural activities. Therefore, the population under study lived in different societal conditions than the population analysed by Helle *et al*., which was mainly involved in fishing, hunting and herding (Helle *et al.*, 2002). Indeed, it is uncertain whether the described phenomenon has the same strength in any type of society. For example, it cannot be excluded that in an agricultural society the number of sons had a positive effect on maternal health. Agricultural activities imposed a high level of work-load on every family member, especially in Moerzeke (De Beule, 1962). On many farms, women worked together with their husbands in the fields or on the farm (De Beule, 1962). Having a lot of sons may have reduced the work-load on women. This factor might have counteracted the negative effect of the biological consequences of giving birth to sons.

Multiple regression analysis is used to test whether sons had a negative effect on maternal longevity in this village. The independent variables are: 'number of sons', 'number of daughters', 'age-at-death of the partner' and 'year of birth' (Model 1, see Table 1). For 'number of sons' and 'number of daughters', a set of dummy variables is used. The reference groups are respectively 'no sons' and 'no daughters'. Other categories are: '1 or 2 sons' (daughters), '3 or 4 sons' (daughters) and '5 or more sons' (daughters). If the number of sons is related to maternal longevity, negative parameter values should be found, in particular for the latter two categories.

The analysis (see Table 1) does not reveal any effects of the number of sons on maternal longevity. This does not, however, mean that the findings of Helle *et al.* are

not applicable to the setting of Moerzeke. There are in particular two ways of refining the analysis.

The influence of social position and period

Firstly, there may be differences by social position. Mortality is of course not only affected by immunity. The allocation of resources (e.g. nutrition), and differences in lifestyle and hygiene are also important (Schellekens, 1989). As these factors possibly suppress the negative effect of having sons, well-to-do families might in general have been more able to cope with the negative consequences of having sons. To address this, wives in well-to-do families are compared with wives of ordinary labourers. More specifically, a distinction is made between the well-to-do families in the non-agricultural sector (merchants, owners, bakers, etc.) and the well-to-do families in the agricultural sector ('farmers') versus families of ordinary labourers, such as '(farm-) labourers', 'day-labourers', etc. The qualification 'well-to-do' is only used to indicate the relative better social position of these groups compared with the ordinary labourers. It must be noted that this classification is based on occupational titles and that the use of these titles for socioeconomic classifications is not without limitations in agricultural societies.

Secondly, Helle *et al.* (2002) refer to a pre-industrial population and suggest that the negative effect is limited in time. Pre-industrial society differed in many respects from modern society. In the perspective of the claim that it is the immunosuppressing role of testosterone that is the presumable cause of the negative effect of sons, it is important to stress that during the observation period the disease pattern was also gradually changing. It was mainly during the 18th century that major mortality crises occurred (De Ridder, 1986) and infectious diseases were important. More specifically, the village under study was possibly strongly affected by malaria (as the ecological conditions there were favourable for the development of malaria; see Devos, 2001). Malaria patients also had less resistance against, for example, dysentery (of particular importance in Moerzeke; De Ridder, 1986), smallpox and typhus. Malaria declined in Flanders during the 19th century (Devos, 2001), and infectious diseases also gradually decreased in importance ('stabilization of death'). Furthermore, socioeconomic life conditions also changed. The standard of living improved gradually, creating a different socioeconomic environment.

To tackle this problem, the analysis is limited to women born before 1815. Firstly, longevity (of the selected group of women) does not structurally increase in the selected period. Secondly, it is certain that most cohorts of women born before 1815 experienced poor socioeconomic conditions in their adult years. The youngest cohorts of this group had, for instance, experienced the crisis of the 1840s (important in Moerzeke; see De Beule, 1962). Women born after 1815 experienced gradually changing longevity and socioeconomic conditions.

To sum up, it is expected that if there is a relation between the number of sons and maternal longevity, this will be especially visible for wives of ordinary labourers (born between 1700 and 1815). In Model 2 (see Table 1), 'social position' is added as a dummy variable (1 = well-to-do, 0 = ordinary labourers) and interaction parameters are constructed ('social position' × 'number of sons' and 'social position' × 'number of

Table 1. Multiple regression analyses of the effect of the number and sex of offspring on maternal longevity (women: born and deceased in Moerzeke, surviving their fiftieth birthday, not remarrying)

Model	Selected group	*n*	Variables	*b* parameter	*t* value	Significance
Model 1	1700–1870, total group	1062	Number of sons=0 (ref.)			
			Number of sons=1 or 2	−174·17	−0·416	0·678
			Number of sons=3 or 4	−753·91	−1·747	0·081
			Number of sons=5 or more	−400·57	−0·899	0·369
			Number of daughters=0 (ref.)			
			Number of daughters=1 or 2	41·83	0·102	0·919
			Number of daughters=3 or 4	120·48	0·281	0·778
			Number of daughters=5 or more	86·45	0·196	0·845
			Age-at-death of partner	0·02	0·643	0·521
			Year of birth	6·54	2·540	0·011
Model 2	1700–1815, total group	611	Number of sons=0 (ref.)			
			Number of sons=1 or 2	−1344·4	−2·091	0·037
			Number of sons=3 or 4	−1656·7	−2·498	0·013
			Number of sons=5 or more	−1670·6	−2·435	0·015
			Number of daughters=0 (ref.)			
			Number of daughters=1 or 2	605·0	0·960	0·337
			Number of daughters=3 or 4	290·7	0·451	0·652
			Number of daughters=5 or more	297·8	0·427	0·669
			Social position	−741·4	−1·060	0·289
			Social position (well-to-do) × number of sons=1 or 2	2148·2	1·978	0·048
			Social position (well-to-do) × number of sons=3 or 4	1229·8	1·064	0·288
			Social position (well-to-do) × number of sons=5 or more	2607·2	2·131	0·033
			Social position (well-to-do) × number of daughters=1 or 2	−1064·3	−0·971	0·332
			Social position (well-to-do) × number of daughters=3 or 4	−493·2	−0·420	0·674
			Social position (well-to-do) × number of daughters=5 or more	−369·4	−0·309	0·757
			Age-at-death of partner	0·009	0·264	0·792
			Year of birth	−9·976	−1·974	0·049

Table 1. *Continued*

Model	Selected group	*n*	Variables	*b* parameter	*t* value	Significance
Model 3	1700–1815, wives of ordinary labourers	407	Number of surviving sons=0 (ref.)			
			Number of surviving sons=1 or 2	−1047·7	−2·038	0·042
			Number of surviving sons=3 or 4	−1523·5	−2·703	0·007
			Number of surviving sons=5 or more	−1649·8	−2·452	0·015
			Number of not-surviving sons=0 (ref.)			
			Number of not-surviving sons=1 or 2	−958·2	−2·424	0·016
			Number of not-surviving sons=3 or more	540·9	0·836	0·404
			Number of surviving daughters=0 (ref.)			
			Number of surviving daughters=1 or 2	251·0	0·504	0·615
			Number of surviving daughters=3 or 4	236·3	0·432	0·666
			Number of surviving daughters=5 or more	1314·9	1·902	0·058
			Number of not-surviving daughters=0 (ref.)			
			Number of not-surviving daughters=1 or 2	624·5	1·561	0·119
			Number of not-surviving daughters=3 or more	−840·1	−1·228	0·220
			Age-at-death partner	−0·01	−0·295	0·768
			Birth year	−4·799	−0·830	0·407

daughters'). The main effect estimates of 'number of sons' and 'number of daughters' show the parameters for the reference category (wives of ordinary labourers). The interaction parameters show the difference (in *b* parameter) between the indicated category (well-to-do) and the reference category (wives of ordinary labourers).

The analysis (see Table 1) shows that there is a negative effect of giving birth to sons for wives of ordinary labourers born between 1700 and 1815. The *b* values for 'number of sons = 1 or 2', 'number of sons = 3 or 4' and 'number of sons = 5 or more' are respectively − 1344, − 1657 and − 1671. This means, for instance, that having five or more sons decreased maternal age-at-death by 1671 days (about 4·5 years) compared with having no sons at all. No similar negative relation between the number of daughters and maternal longevity is found.

For wives in well-to-do families, such a clear relation is not found. The estimates for the *b* parameters are respectively 804 (− 1344 + 2148), − 427 (− 1657 + 1230) and 936 (− 1671 + 2607). For 'number of sons = 1 or 2' and 'number of sons = 5 or more', the interaction parameter is significant, confirming the difference between wives of ordinary labourers and wives in well-to-do families.

Intra-household resource competition as an alternative explanation

There might be an alternative non-biological explanation for the negative effect of sons on maternal longevity. Resistance to diseases is also affected by access to resources, which is conditioned by the household context, such as size, age and sex composition, etc. (Campbell & Lee, 1996). Indeed, in pre-industrial times the household seems to be the most important locus in the allocation of survival-related resources (Klasen, 1988). Tsuya states that 'Household resources and position that individuals occupied within a household influenced chances of survival especially in adult and elderly years' (Tsuya, 2001). Intra-household resource allocation is therefore a factor to consider in this debate on the negative effect of sons on maternal longevity. An example of this may be the high level of food competition within the household, especially in those households living on the margins of survival. It is probable that females suffered more from food competition than males (Wall, 1981; Alter *et al.*, 2001). Males could for instance use their role in physical labour to ensure their position within the household. Therefore the number of sons may affect the mother's share of the household resources more than daughters. This mechanism has also been observed in contemporary populations (Gittelsohn, 1991; Miller, 1997; Ralston, 1997), although precise patterns may vary from place to place and from time to time. The main point is that this type of effect does exist and that a social explanation of the effect of having sons on maternal longevity cannot be excluded as such. This view is furthermore consistent with the social location of the effect: that is, the absence of the effect in the well-to-do families. It is logical that in those groups where resources were most limited, mortality caused by intra-household competition is greatest.

To tackle this problem, the group for which the relation between the number of sons and maternal longevity is found is analysed in more detail. The above-mentioned factor is controlled for by comparing the effect of sons of different ages. The biological consequences described by Helle *et al.* (2002) are exercised during

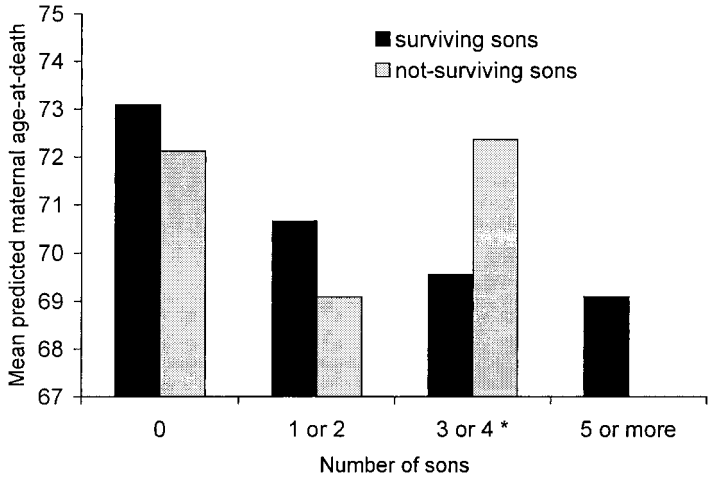

Fig. 1. Mean predicted maternal age-at-death, the influence of having sons (surviving and not surviving 5th anniversary) on maternal longevity (ordinary labourers, 1700–1815, $n=407$). *=3 or more for not-surviving sons.

pregnancy. This means that every son, whether dying early or later in life, must contribute to this negative effect. Social consequences are, on the contrary, probably exercised later in life. In the case of food competition, it is clear that sons can only affect longevity if they survive, say until the age of five. Therefore, if food competition is the cause of the negative effect of sons, the effect should only be observed for sons surviving their fifth birthday.

This is tested by replacing the set of variables measuring the 'number of sons' by two sets of variables: 'number of not-surviving sons' (dying before their fifth anniversary) and 'number of surviving sons' (dying after their fifth birthday) (Model 3, see Table 1). Again, dummy coding was applied. The same is done for the variable 'number of daughters'. The analysis of the wives of ordinary labourers born between 1700 and 1815 shows effects for all categories of 'surviving sons' ($b=-1048$, -1524 and -1650 respectively). This is not the case for not-surviving sons. Only for women with one or two not-surviving sons is the parameter negative and significant, as shown in Table 1 and Fig. 1. This result suggests that the effect of sons on maternal longevity is mainly caused by mechanisms present after those sons have reached the age of five.

This strategy of differentiating by age is also applied to daughters (Model 3, see Table 1 and Fig. 2). The parameter for 'number of surviving daughters=5 or more' is positive and borderline significant ($p=0{\cdot}058$). Also in this analysis, no similar negative relation between the number of daughters and maternal longevity is found. This suggests that the influence of surviving children differs by sex, and confirms the above-mentioned interpretation.

Conclusion

This analysis confirms the relation between number of sons and maternal age-at-death. As in the Sami population, a negative effect of sons on maternal longevity was

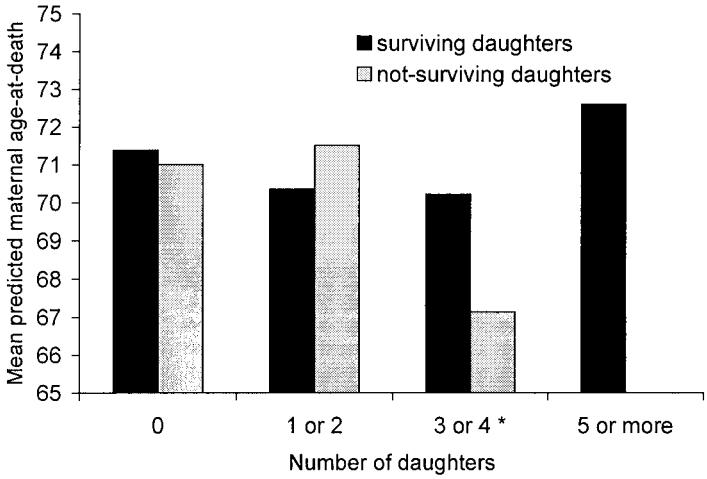

Fig. 2. Mean predicted maternal age-at-death, the influence of having daughters (surviving and not surviving 5th anniversary) on maternal longevity (ordinary labourers, 1700–1815, $n=407$). *=3 or more for not-surviving daughters.

found in this Flemish village. This effect was only observable for wives of ordinary labourers. Wives in well-to-do families did not show the same pattern. There are two possible reasons: firstly, the latter group may have been able to suppress the negative aspects of giving birth to sons, or secondly, the negative effect may primarily have been based on non-biological mechanisms that are not present in this group. It is important to stress that in the group where the negative effect of sons is present, the effect is mainly observable for sons reaching at least the age of five. This suggests that the negative effect was not imprinted during pregnancy but at a later stage of life and hence that it is the second – social – explanation that holds. One possible alternative explanation addressed here is the effect of resource competition as a cause of relative neglect of females. These claims are consistent with findings obtained by research on links between intra-household resource allocation and mortality. Of course, the influence of other (social) factors cannot be excluded. In short, the findings presented in these analyses make the biological explanation relative.

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